

Study of Lake Turkana for Water Projects

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Abstract

The first section of the report is focused on background research of Lake Turkana. It includes information on the local climate, its issues, and their implications. The area surrounding Lake Turkana in the recent years have experienced extreme weather events such as droughts and flooding. It has created a negative impact on the community in various ways thus making access to clean water even more difficult.

The second section is focused on project proposals and development. The projects are aimed at giving aid to the community of Turkana in this ongoing water crisis. The various projects are water distillation, water harvesting, lake preservation and water distribution, all of which are helping towards achieving Sustainable Development Goal 6: clean water and sanitation.

Sustainable Development Goals

Sustainable Development Goals (SDGs) are global development targets created by the United Nations. All countries are working towards achieving these goals by 2030. This case study is connected to several SDGs; the SDG numbers are 1, 2, 3, 6, 9, 11 and 16. The main focus of this research is on goal number 6: clean water and sanitation, where project proposals are aimed at providing clean drinking water to people living in rural areas of Kenya. All other goals are related to the background research, and the projects also contribute towards it.

6 CLEAN WATER AND SANITATION



SDG 6 icon <https://images.app.goo.gl/mCj7WWNz7AGJffxL7>

Background

Introduction to Lake Turkana

Lake Turkana, one of the largest lakes in Africa, is located in northern Kenya. The area of Lake Turkana Basin is 70 thousand square kilometres, making it the world's largest desert lake. The water in the lake is the most saline in East Africa.

The climate in Northern Kenya

General Climate

In northern Kenya, the area is semiarid and arid, with irregular precipitation levels and high temperatures. The area around Lake Turkana has low amounts of rainfall and is generally arid. There are, however, rainy seasons during March, April and May; Lake Turkana receives freshwater from inflow rivers such as the Omo River during the long rains. There are no river outflows so a decrease in lake water is naturally caused by evaporation.

Climate issues

In recent years, there have been four failed rainy seasons which has caused huge fluctuations in Lake Turkana's water levels. North-western Kenya has been experiencing droughts in the past couple of years. Aside from droughts, the eastern area has also experienced flash floods due to heavy rainfall four years prior. As a result, the lake has expanded by more than 10% over the last decade (swallowing up around 800 square kilometres of land). Climate change is contributing to extreme variations in weather systems, and it will continue to increase the weather severity as the years pass.

Implications on the community***Agricultural, economic and environmental impacts***

The agriculture sector in Kenya employs a majority of the population and contributes well to Kenya's economy. Crops such as corn and wheat are produced for consumption in the country, and it is the same with most livestock and dairy products. Even as the country relies on agriculture for food and economic gains, the land and climate are not highly suitable for agriculture. Only a small portion of land in Kenya can be used for agriculture (less than one-tenth of all land). There is a shortage of water due to the climate, and there is poor infrastructure (such as irrigation systems). Also, there is little forestry in Kenya; forestry is crucial for conserving Kenya's water and soil resources. As demands for resources increase with the human population, the forest diminishes even further. The impacts on the environment will worsen if there are no effective interventions.

Impact of the drought

The ongoing drought has negatively impacted the people of Turkana in more ways than one. As a result of the drought, access to fresh water for consumption and irrigation is becoming even more difficult. It has also caused a decrease in food production as agriculture continues to suffer. Turkana has been experiencing food insecurity for decades, and the drought has made it more severe. Year by year, food and water scarcity is becoming worse and more food aid is required. The community requires a more sustainable way to source their daily necessities like food and clean drinking water; instead of continuing to rely on emergency food response.

Impact of the flooding

Due to flash flooding and the steadily rising water levels, settlements near the lake are losing their homes as the lake expands. Their livelihoods are also destroyed, leaving them with

no clean water, food, shelter and no way to earn money for a living. Hundreds of thousands of people have been displaced, and even as they move their settlements further away from the lake, the increasing water levels continue to become an issue. People are not able to move too far away from the lake as they rely on the lake water as a resource. Even though the water of Lake Turkana is not suitable for consumption due to its salinity and high levels of fluoride, people still drink that water as fresh water is scarce.

Impact on children and women

Most of the time, it is the children and the women that are tasked with gathering water for their families. Searching for freshwater daily can be time and energy-consuming; many high school students drop out or have their school grades drop as they have to prioritise getting water for their families. Research conducted in 24 sub-Saharan African countries shows that women of all ages are more likely to be designated water collectors for their families. It creates gender inequality as females are oftentimes tasked to complete unpaid time-consuming chores. It gives women less time and opportunity to search for jobs or work a paid job because it is difficult to meet their family's basic necessities. These water collection trips can take longer than 30 minutes, and it is estimated that 3.36 million children and 13.54 million women are the ones who make those trips. Since these containers of water are carried on the top of their heads or on their shoulders for long periods, it negatively impacts their physical well-being, especially on their backs and spines.

Proposed projects

There are several projects in development focused on solving the water scarcity issue in Kenya. The projects are in varying stages of development, and all projects are contributing towards sustainable development goal number 6: clean water and sanitation.

Current projects

The project aims to provide aid to the local community and conserve Lake Turkana. There are two proposed solutions: one is a water desalination process, and the other is a water harvester from dry air. To help conserve Lake Turkana, there are also three projects that are under development.

Water Desalination project

Using inexpensive desalination techniques, water from Lake Turkana can be treated for water consumption. Using a layered system, heat from the sun is absorbed to create a thin layer of water sitting atop the water source. A square meter (about a square yard) of collecting area should be sufficient to provide a family's daily needs for drinking water. Its advantage is that it uses cheap materials and renewable natural resources. The disadvantage is that the process is slow, and the water does not contain minerals.

Water Harvester project

A water harvesting hardware for the generally arid areas of Kenya is proposed by George Albercook. Through the process of ethanol vapour pressurisation, condensation produces clean drinking water. The hardware will create approximately 318 millimetres of clean water in one cycle. This creates a short-term solution. It is a reliable method that uses renewable resources.

However, the downside is that it can be expensive to produce, complicated to assemble and may require maintenance.

Lake preservation

The project involves building bunds at regular intervals to protect the water of Lake Turkana from flooding. There is also research regarding polyculture reforestation to introduce fertility into the soil. It can support irrigation using water from Lake Turkana and Turkwall River from the bunds. Another research topic is radioactive sky-cooling technology to create precipitation through conduction and convection.

Water Transportation Project Ideas

The following project ideas explore the different possibilities of developing water transportation for communities in rural areas. Since harvesting water is a difficult time and energy-consuming task, often assigned to children and women, these projects are aimed at helping them have easier access to water.

IDEA 1: Individual transportation

What is the aim of this project?

- Build a contraption that will make it easier to haul containers of water (most specifically, round barrels)
- Increase efficiency so it will take less time and energy to get water

What is the current situation like?

- People carry water in plastic barrels
- They sometimes drag it behind them by attaching a rope to 2 ends, but they mostly carry it over their head, or shoulder

- People of all ages are assigned to get water for their family: mainly women and children
- They travel to any water resource they can find: usually, water found underground such as wells



Carrying water in Kenya <https://images.app.goo.gl/JWHtGiLEGntPZvLa7>

How can the aim be achieved?

PROTOTYPE 1: Provide a trolley with 2 wheels that households can use

- Barrels sit on top of the trolley
- Will need huge, sturdy wheels to be usable in rough rocky terrain
- Can possibly carry 2 barrels
- Secure using rope

PROTOTYPE 2: Create an attachment to existing water barrels

- Water barrels need to be sealed so it must have a secure lid.
- Will need to attach a pivot point so the barrel itself can spin on the axis

- Double wheels: Bearing attached firmly onto both ends of the barrel using a strong adhesive. The bearing will have an axle for the whole barrel to spin on its axis.
- Handles could be rope attached from the axle. The rope can be pulled by hand or could be attached over the waist

PROTOTYPE 3: Create an attachment to existing water barrels

- Similar to prototype 2
- Replace handles with metal, or plastic bar handles so the wheel can be pushed instead of pulled
- Issue with accessing the top lid of the barrel: the bar will restrain the lid. Make the bars detachable from the lid

PROTOTYPE 4: Create new water barrels

- Already an existing concept
- This will be suitable for people who do not currently have a sealed water barrel
- Requires more money for production
- Could possibly increase the radius of the barrel to hold more water



Wheelbarrow Water <https://www.trendhunter.com/trends/wheelbarrow-water>



Waterwheel <https://phys.org/news/2011-02-waterwheel-thirsty-world.html>

Any concerns/possible issues?

- The terrain may be an issue: uneven terrain will prevent ease of use
- Will they actually use it?

IDEA 2: Increasing home water storage

What is the aim of this project?

- Increasing water storage so fewer trips will be required
- Can store more water at home
- Can also collect and store rainwater

What is the current situation like?

- Household storage capacity, averaging about 250 litres per household, is often made up of a number of smaller containers.
- The total capacity is insufficient, according to research participants.

How can the aim be achieved?

PROTOTYPE 1: Large plastic containers

- Build and provide large water plastic containers for households

PROTOTYPE 2: Foldable containers

- Foldable containers made out of soft plastic



Sample rainwater collection kit

<https://www.mitre10.co.nz/shop/jobmate-rainwater-collection-kit-300-litre-grey/p/368800>

PROTOTYPE 3: Standalone rainfall harvester and container

- Use a tarp to collect rainwater
- Tube to lead into the tank
- Tank stores rainwater



Stand-alone rain collector <https://www.instructables.com/Stand-alone-rain-collector/>

Any concerns/possible issues?

- Production cost
- It may cost a lot of money to provide this for every household
- An option to provide a few for a community (1 tank shared to multiple households)

IDEA 3: Larger transportation

What is the aim of this project?

- Increasing amount of water transported so fewer trips will be required
- A larger contraption that carries more barrels of water
- Can provide a few per community

What is the current situation like?

- There are wheelbarrows for donkeys to pull

- 2-wheeled wheelbarrows or 4-wheeled carts

How can the aim be achieved?

PROTOTYPE 1: 2-wheeled

- Wheelbarrow structure
- One end has 2 handles that could be attached to a donkey or any other large animal (such as horses)
- Can secure multiple barrels in the wagon using ropes

PROTOTYPE 2: 4-wheeled

- Cart structure
- Could potentially carry a heavier load (more water barrels) since the size of the cart can be made larger
- Could have a built-in water tank, but it will be a lot more challenging to fill with water. Dispensing water could be done with a tap mechanism

Any concerns/possible issues?

- It would be difficult for rough terrain
- Built on the assumption that they have animals to pull it
- If humans pull it, it may require more than 1 person (but would still be more efficient if they are carrying several barrels filled with water that could be used by more than 1 household)

IDEA 4: Water transportation service***What is the aim of this project?***

- Have an established company that delivers water to the community for little to no cost
- It can get water delivered to more people with ease
- Reduce the need for people to go out and gather water daily
- Reduce gender inequality so women (who usually travels to get water for their family) will be able to spend more time on other activities such as working
- Can increase employment in the community as you could train and hire people to be the one to deliver the water

What is the current situation like?

- There are water companies that increase water prices, especially in urban areas
- Pipe infrastructure is available in urban areas but not in rural areas and it would not be a viable option for rural areas

How can the aim be achieved?***PROTOTYPE 1: Transport vehicle - a non-profit organisation***

- Large water tank in a vehicle (car with a trolley or an open SUV truck) that travels from water desalination plants to communities
- Communities can fill up their water storage from the tank
- The company could be non-profit so all the money earned will be used to keep the organisation going
- If it is possible to gain funding through donations, it will only go towards the vehicles, tanks and gas

Any concerns/possible issues?

- It assumes that communities can be accessed by vehicle
- Where will the company source the funds for the project? Is it an option to gain funding from the government? Or could the company work through donations only?

Summary

The background study on Lake Kenya researches the area's climate and the ongoing climate issues such as droughts and flash flooding. The research on the various implications on the people gives an insight into the reasons for needing projects to propose solutions.

All four proposed projects are short-term solutions to water scarcity in Kenya. They are aimed to help alleviate the difficulty of harvesting water daily. It contributes to Sustainable Development Goal number 6: clean water and sanitation. To create a long-lasting impact, establishing a working framework within the government that adequately addresses the water scarcity issue for all people of Kenya. A viable long-term solution requires effective management of public resources, such as water, to ensure that all communities, especially those marginalised, can sustainably get their necessities. Establishing international cooperation with neighbouring countries (specifically Ethiopia, where river Omo flows into Lake Turkana) to prioritise the conservation of water resources would also help with long-term sustainability.

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